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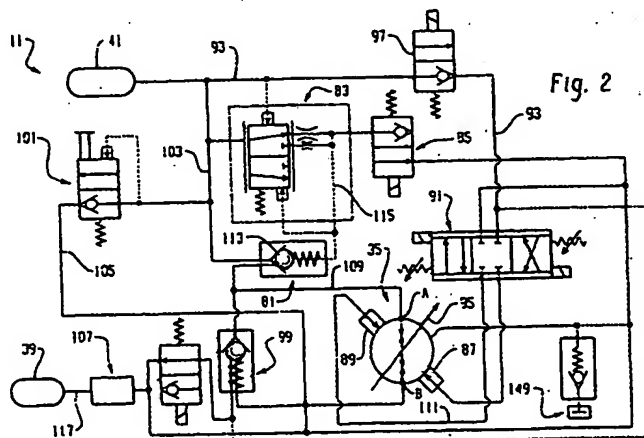
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### (54) Hydraulic drive system

(57) A pump-motor unit (35) including a swashplate (95) having a neutral position (FIG. 3) and first and second displaced positions and comprising first (87) and second (89) pressure actuators associated with the swashplate. Displacement of the swashplate is proportional to substantially only the difference in fluid pressure between a high pressure source (41) and a low pressure source (39). The first pressure actuator includes a first control

piston (121) having a first effective area (A1), and the second pressure actuator includes a second control piston (127) having a second effective area (A2), the second effective area being at least somewhat greater than the first effective area. If the high and low pressure sources are at substantially the same pressure, the pressure acting on both of the first and second effective areas will displace the swashplate from neutral toward the second displaced position.



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## EUROPEAN SEARCH REPORT

Application Number  
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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	GB 1 215 289 A (DAVID WILTON EVANS; EDWARD LARGE) 9 December 1970 (1970-12-09) * page 1, line 82 - page 3, line 23; figures 1,2 *	1-3	F16D31/02 B60K17/10
A	US 6 248 037 B1 (FORSTER FRANZ) 19 June 2001 (2001-06-19) * abstract; figure 1 *	1-3	
			TECHNICAL FIELDS SEARCHED (IPC)
			F16D B60K B60T F15B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 13 December 2005	Examiner Blumenberg, C
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.

EP 05 01 7532

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
GB 1215289	A	09-12-1970	NONE	
US 6248037	B1	19-06-2001	DE 19903563 A1	03-08-2000
			JP 2000220559 A	08-08-2000

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82